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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/270,606	03/17/1999	DAVID RUSSELL EVANS	SLA 587 (SMT 335)	2733

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EXAMINER
ANDERSON, MATTHEW A

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 12/05/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

AS-18

Office Action Summary	Application No.	Applicant(s)	
	09/270,606	EVANS, DAVID RUSSELL	
	Examiner	Art Unit	
	Matthew A. Anderson	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 September 2002*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 March 1999* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a)☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4)☐ Interview Summary (PTO-413) Paper No(s). _____.
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other: .

DETAILED ACTION

Claim Rejections - 35 U.S.C. 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kodera et al. (US 5,445,996) in view of Grover et al. and further in view of Burke et al. (US 5,934,978).

Kodera et al. discloses a method for planarizing an insulating film using an aqueous slurry containing dispersed cerium oxide in col. 19-20 as the preferred embodiment. In Fig. 19, the polishing method of overlaid SiO_2 insulation on a polysilicon patterned layer is described visually. The recesses between the raised portions were seen in Fig. 19E. Fig. 19F shows a planar surface. In col. 20 lines 45-50, the surface is described as completely planarized. This implies that the high structures are preferentially polished until they are removed. This in turn implies the rate of polishing the high structure areas at a higher rate than the low areas. Otherwise

planarization would not be attained. In col. 44 lines 3-11 the use of a surface active agent is disclosed. Kodera et al. discloses the optimization of friction to cause a uniform polishing rate. It is obvious to those of ordinary skill in the art that the processing parameters such as abrasive concentration and pressure applied will affect the friction in a direct relationship. The lack of an etch stop layer or dummy structure is disclosed in col. 37 lines 44-64. The complete planarization of an insulating film with undulations is described as not requiring a dummy structure (i.e. a etch stop or polishing stop layer). Fig. 51 discloses shows a near constant polishing rate when using a surfactant (one which was disclosed as not limited to polycarboxylic acids) in the slurry to keep the slurry from choking the polishing cloth. The slurry so modified is shown to polish at a near constant rate over time regardless of the target structure polished (col.44 line 10).

Kodera et al. does not explicitly disclose the use of ethylene glycol in such a slurry.

Grover et al. discloses a method of chemical mechanical polishing (CMP) using a slurry containing cerium oxide (Col. 4 lines 40-45). The slurry also contains an additive (i.e. a modifier) comprised of a carboxylic acid. The method is disclosed as useful for STI (shallow trench isolation). STI is discloses in Col. 1 lines 25-37 as follows: silicon nitride is deposited over a thermal oxide; a shallow trench is etched; a layer of oxide is deposited over the into the trench; the excess oxide is polished using CMP such that the surface is planar (i.e. the high spots are removed and the low spots are essentially untouched. In Col. 5 lines 60-63 the percentage of the metal oxide abrasive is

disclosed as from about 2-25 % by weight. In Col. 7 lines 40-53 is described the methods of the enclosed Examples including the down force of 9 psi.

Burke et al. discloses in Cols. 3 and 4, lines 60+ and 1-9, respectively, the addition of a suspension agent which improves the colloidal behavior of the abrasive particles in deionized water and inhibits the coalescence of the particles. Ethylene glycol is disclosed as an alternative suspension agent. In col. 4 lines 9-15, ceria (i.e. cerium oxide) is disclosed as the abrasive particles in the slurry. Those of ordinary skill in the art know that the terms surface active agent or surfactant are equivalent to the term suspension agent.

It would have been obvious to one of ordinary skill in the art at the time of the present invention to combine the references cited because Kodera et al. discloses a CMP process where the ceria containing slurry polishes the high spots at a nearly constant rate while the low spots are virtually untouched, Grover et al. adds known process parameter data to the mix, and Burke et al. discloses the use of a suspension agent (ethylene glycol) which would increase solubility of the colloidal particles of ceria and help it stay in the aqueous solution and not coalesce.

In regard to claims 1, 10-11, 14,16, 17 it would have been obvious to one of ordinary skill in the art at the time of the present invention to form a slurry containing ceria , use that ceria containing slurry to polish the high spots of a SiO_2 structure at a nearly constant rate (without the use of a dummy or polish stop layer) while the low spots are virtually untouched because such a method is described by Kodera et al. in Fig. 19, Fig. 51 of Kodera.

In regard to claims 2-9, 12, 18, 19, it would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the process parameters of cerium oxide (ceria) concentration between 1%-50% weight (Kodera et al) and pressure between 5-10 psi because these were known in the art (Grover et al.) and such optimization would have been achieved with only routine experimentation.

In reply to claims 4,7,8,15, 20, it would have been obvious to one of ordinary skill in the art at the time of the present invention to optimize the amount of ethylene glycol in such a slurry because the addition of ethylene glycol in a ceria-containing CMP slurry to affect the suspension and ultimately the polishing properties of the slurry was known, such optimization would have been anticipated to produce an expected result, and such optimization would have been achieved with only routine experimentation. Kodera et al. discloses that surfactant in the slurry keeps the polishing rate constant by preventing the "choking" of the polishing pad in Col. 44.

Response to Arguments

3. Applicant's arguments filed 9/20/2002 have been fully considered but they are not persuasive.

4. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir.

1986). Kodera discloses a dispersed ceria slurry that achieves complete planarization of a silica layer that has high structure areas and low structure areas. This suggests that the high areas are polished away faster until planarization is achieved. Since Fig 51 implies that the polishing rate is constant regardless of the surface polished when using a dispersant, it follows that the high spots are etched at a rate approximating the blanket polishing rate. This also implies that the low spots are polished at *substantially* a zero rate relative to the high structure areas. There is no use of a stopper layer in the description of Fig. 19. The surfactant ethylene glycol was known in the art (as a modifier of slurry properties. The pressures common to CMP are found in Grover.

The arguments concerning Figs. 22-27 of Kodera are acknowledged but are moot in light of Figs. 19 and 51 of the same reference. Kodera et al. discloses that complete planarization is possible without any stopper or hard stop layers (Kodera col. 37 lines 55-65).

The argument that Grover is not applicable is not convincing. Grover is used to disclose common process parameters (down pressure) in CMP processes. Down pressure is related to friction effects described in Kodera.

The argument against Burke is not convincing in that the use of ethylene glycol as a ceria slurry modifier is therein disclosed. A surfactant (i.e. dispersant) modifies the slurry by dispersing the oxide particles in the liquid medium and preventing agglomerations. Kodera discloses a dispersed ceria slurry and thus suggests the inclusion of a surfactant. Ethylene glycol was known for ceria slurries.

The argument that the references combined do not suggest polishing high areas at a blanket polishing rate is not convincing in light of Figs 19 and 51 of Kodera et al. The high structure areas are polished until they become level with the low structure areas and then the entire surface is polished at a rate essentially the same as that of the high structures (i.e. the high structure polishing rate is essentially the blanket rate.)

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew A. Anderson whose telephone number is (703) 308-0086. The examiner can normally be reached on M-Th, 6:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech can be reached on (703) 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

MAA
December 2, 2002

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